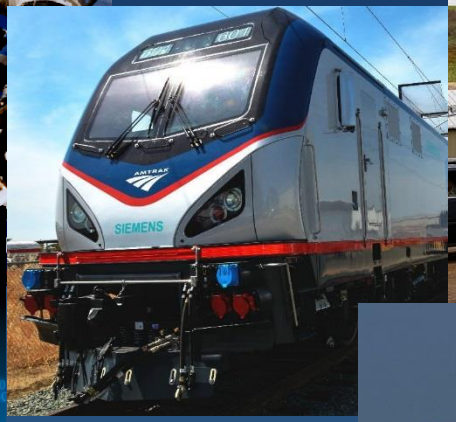
A National Space Weather Strategy

Space Weather Enterprise Forum
20 October 2015

Severe Space Weather – Societal and Economic Impacts



Space Weather Awareness

Multiple efforts underway to address space weather, across government agencies and the private sector – nationally and internationally

- Congress – Critical Infrastructure Protection Act, H.R. 1073; NASA Authorization Act of 2010
- U.S. Regulatory Action – FERC reliability standards
- Space weather in Strategic National Risk Assessment
- FEMA Federal Interagency Response Plan – Will include a Long – Term Power Outage Annex
- International – UN WMO Inter-Programme Coordination Team on Space Weather; FAA and UN International Civil Aviation Organization; NATO space weather teams

The Executive Office of the President

- OSTP Space Weather Interagency Working Group
- *Space Weather Observing Systems: Current Capabilities and requirements for the Next Decade*
- *White House – UK Cabinet Office discussions*

A cohesive all-of government strategy was necessary to ensure the federal government was positioned to mitigate, respond to and recover from a major space weather storm

National Space Weather Strategy

Nov 2014 – Space Weather Operations, Research, and Mitigation (SWORM) Task Force is established

Tasked to develop:

- National Space Weather Strategy (NSWS)
- Space Weather Action Plan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NATIONAL SPACE WEATHER STRATEGY

PRODUCT OF THE

National Science and Technology Council

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April 2015

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National Space Weather Strategy Public Comment Period

- OSTP posted the NSWS to the Federal Register on April 30
- The comment period officially closed on May 29, 2015
- Comments received from academia, the private sector, public interest groups, international organizations, Federal employees, and individuals
- Input was largely positive with support for government initiative and engagement

National Space Weather Strategy – Structure

Draft strategy articulates six high-level goals

1. Establish Benchmarks for Space Weather Events
2. Enhance Response and Recovery Capabilities
3. Improve Protection and Mitigation Efforts
4. Improve Assessment, Modeling, and Prediction of Impacts on Critical Infrastructure
5. Improve Space Weather Services through Advancing Understanding and Forecasting (*R2O/O2R, Observations*)
6. Increase International Cooperation

Space Weather Action Plan

A Space Weather Action Plan (SWAP) is also being developed that will establish a process to implement the National Space Weather Strategy

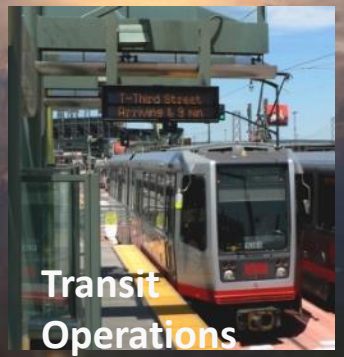
- Strategy must have an accompanying roadmap (action plan) to be successful
- The SWAP will establish specific activities with implementation timelines, detailed actions, and specific agency assignments

Department of Homeland Security

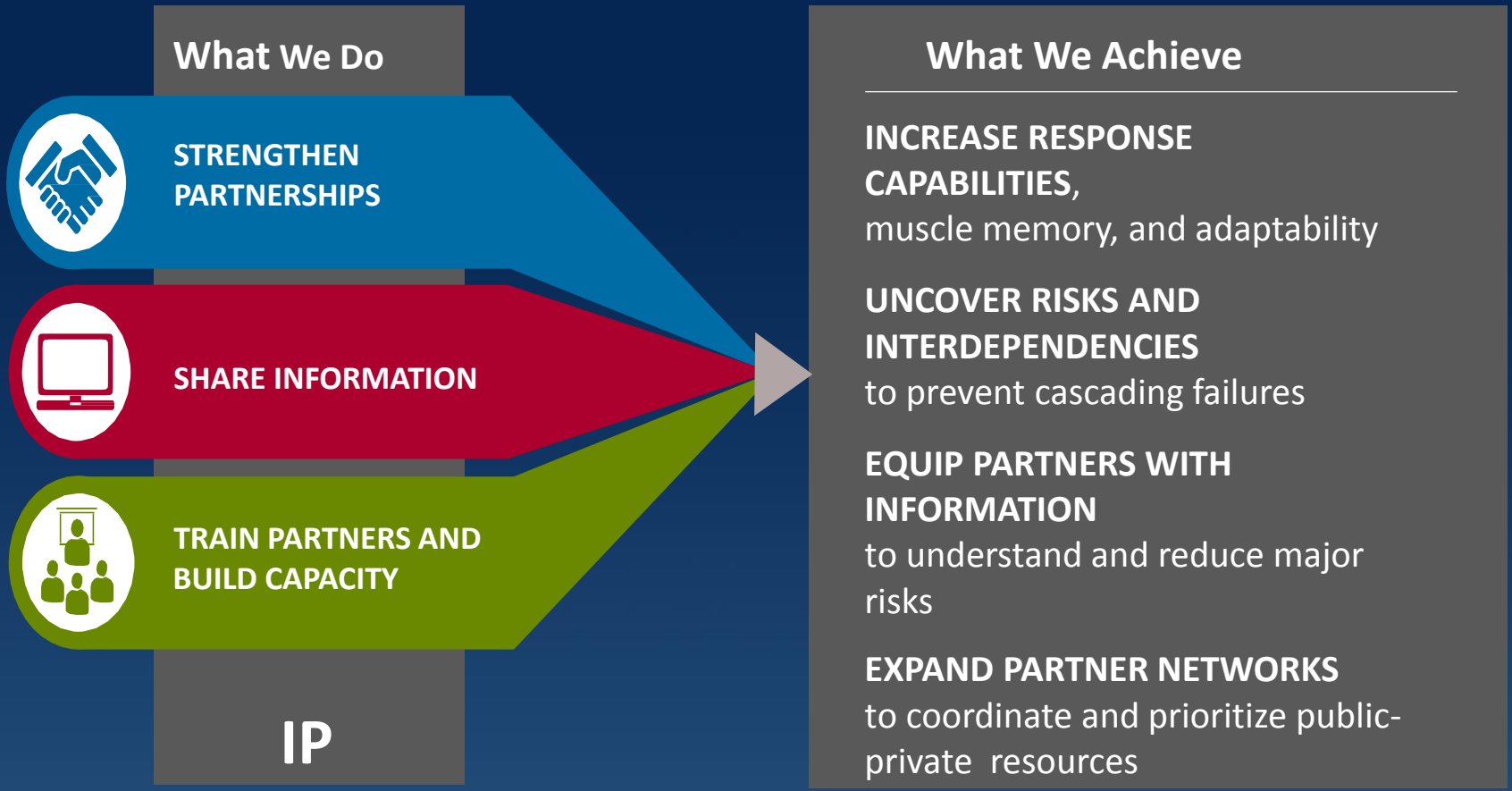
National Protection and Programs Directorate

Sarah Ellis-Peed Office of Infrastructure Protection

Our Economy Depends on Secure and Reliable Critical Infrastructure



How IP Achieves its Mission



The mission is to lead the national effort to protect critical infrastructure from all hazards by managing risk and enhancing resilience through collaboration with the critical infrastructure community.

Improving Protection and Mitigation

IP's Role in Supporting the SWORM

- Assess the relevant legal mechanisms, authorities, and incentives that can be used to protect critical systems
- Encourage the development of hazard-mitigation plans that reduce vulnerabilities to, manage risks from, and assist with response to impacts associated with space weather
- In concert with industry partners, achieve long-term vulnerability reduction to space weather events by implementing appropriate measures at critical locations most susceptible to space weather
- Strengthen public/private partnerships that support private action to reduce public vulnerability to space weather

Strategies for Managing Risk

- Employ an integrated approach to address diverse and evolving risks
- Better understand vulnerabilities
- Educate Partners
- Collaborate with the Private and Public Sectors
- Explore new technologies
- Build resilience into the design
- Buy smart- Invest in resilient technologies

National Oceanic and Atmospheric Administration

Louis W. Uccellini
Assistant Administrator for Weather Services
and Director, National Weather Service

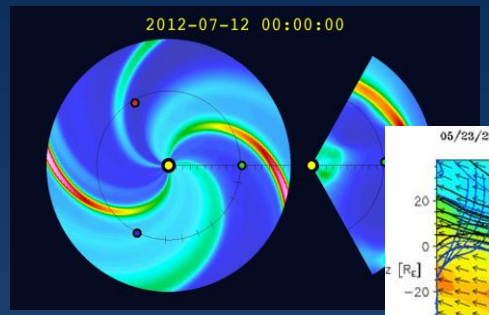
A Weather Ready Nation:

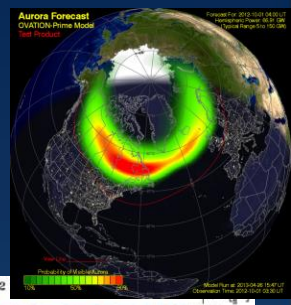
Building our Nation's resilience in the face of increasing vulnerability to space weather

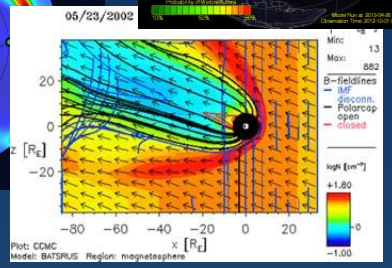
(Addressing SWORM Goals 2 and 3 on Mitigation and Impacts on Critical Infrastructure)

Critical observations

Improved Forecast







Partnerships

Better information connected to key stakeholders and benchmarks for better decisions

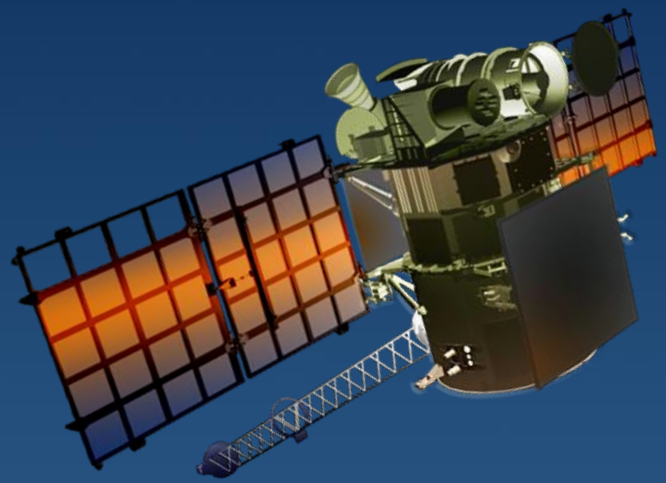
Critical Observations

Ground-based

- Global Oscillations Network Group (GONG)
- USAF Solar Electro-Optical Network (SEON)
- Continuously Operating Reference Stations (CORS)
- USGS magnetometer network
- Neutron Monitor Network

Space-based

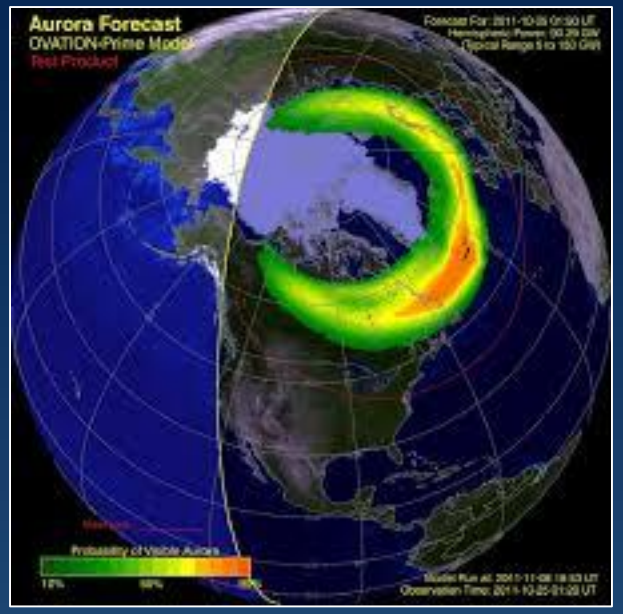
- DSCOVR at L1
- GOES-R at Geosynch
- COSMIC-2 in LEO
- *Coronagraphs at L1 and L5*



Improved Forecast (Modeling)

Currently Operational

- WSA/Enlil
- D-region Absorption Profile (D-RAP)
- N. American TEC profiles (NATEC)
- OVATION Aurora



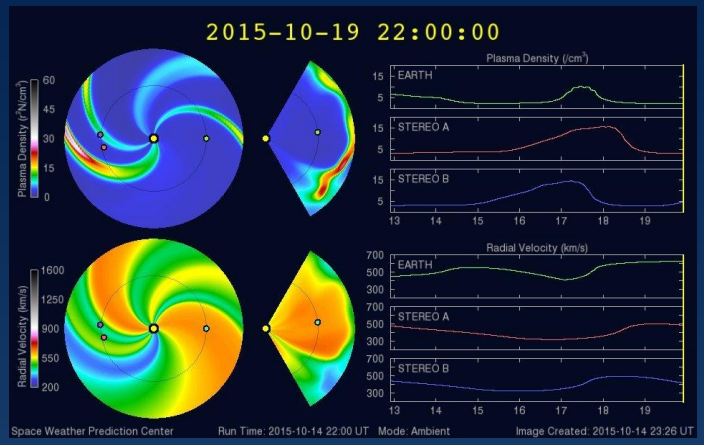
Upcoming

- Whole Earth Model (WAM)
- Integrated Dynamic of Earth's Atmos (IDEA)
- U. Michigan "Geospace"
- E-field model

Partnerships

Science and Modeling

- NASA (Goddard/CCMC)
- NSF (NSO/GONG)
- USAF (AFRL)
- Private Sector (e.g. NWRA, PSI)

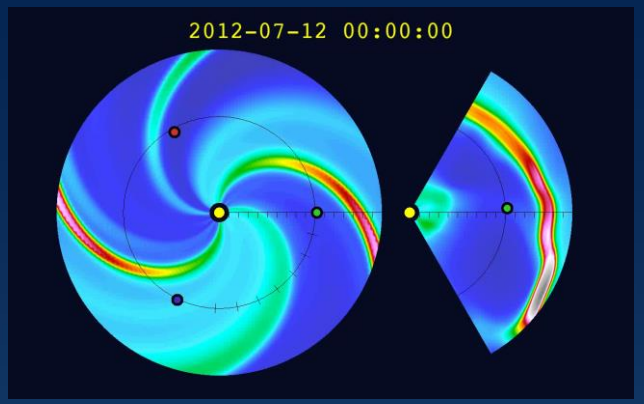


Forecasting Products and Services

- USAF 557th , 2nd WS
- International: UK Met Office, Germany DLR, Korea, Japan, ESA/SSA, etc.
- Private Sector: ASTRA, SET, etc.

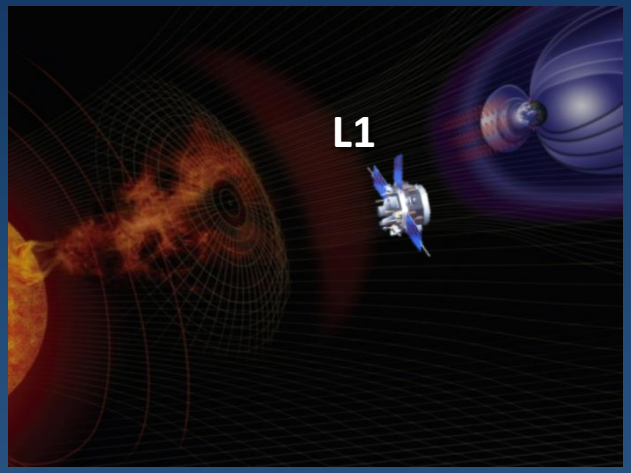
Geomagnetic Storm Prediction – Current Forecast Processes

GLOBAL Specification and Prediction



1. **Geomagnetic Storm Watch**
- Issued upon detection of Earth-directed CME and WSA-Enlil model run
  - **1-3 day forecast**

2. **Geomagnetic Storm Warning**
- Issued upon detection at the ACE spacecraft at the L1 Lagrange point (soon to be DSCOVR)
  - **15-50 minutes before impacting Earth**



3. **Geomagnetic Storm Alert**
- Issued when geomagnetic storm is detected on USGS and international partner magnetometers
  - **Current condition**
  - **Informs key decisions for mitigation**

Modeling SpaceWx– A Sun to Earth Continuum

Partnerships with the Space Weather Research Community

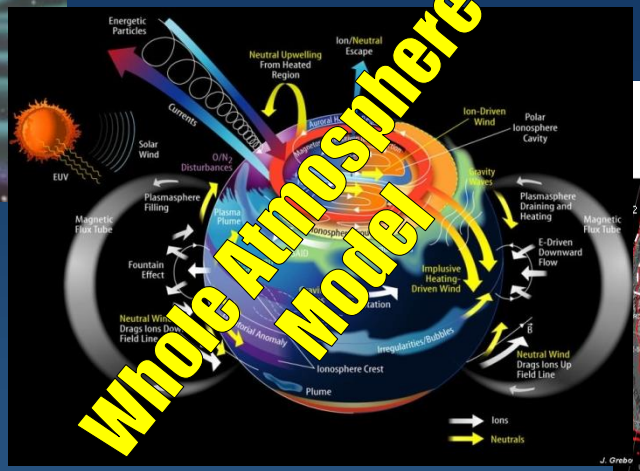
Solar /Solar Wind

Magnetosphere/ Ionosphere

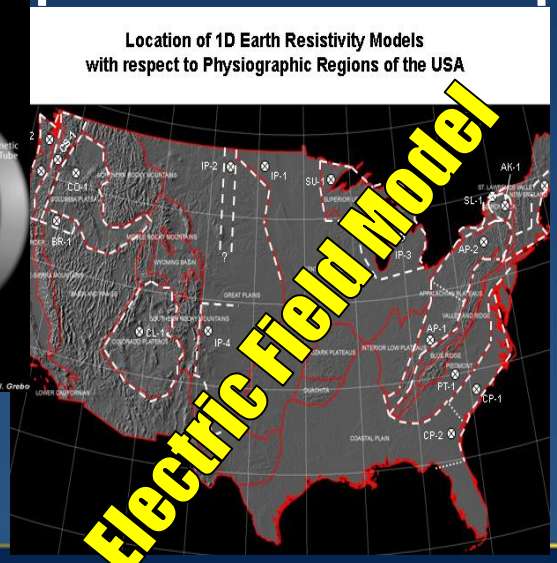
Currently in operations

2016

Ionosphere/ Atmosphere



Earth's surface



Model combination allows for more regional focus

Phase-1 2017

2017

Partnerships & Building Relationships "Can't Do It Alone"

Strategy will require us to strengthen our interagency (R2O/O2R), public-private and international partnerships, and a Whole Community approach. We can and will meet the Nation's needs to protect our critical infrastructure from space weather storms.

THANK YOU!

Space Weather Operations, Research, and Mitigation Task Force

Co-chairs: Tamara Dickinson, Principal Assistant Director for Environment and Energy, OSTP
Caitlin Durkovich, Assistant Secretary for Infrastructure Protection, DHS
Louis Uccellini, Assistant Administrator, National Weather Service, NOAA